

LIDAR in paradise: An alternative method for coral reef mapping and monitoring in the U.S. Virgin Islands

By Matt Patterson and Britton Wilson

SHALLOW CORAL REEFS in the Caribbean Sea were once dominated by elkhorn coral (*Acropora palmata*), but in the 1980s and 1990s, white disease nearly wiped out the genus. This species was generally found atop the reef crest where its massive branches helped protect coastlines by reducing wave impact from approaching storms. These structures also provided refuge to many species of reef creatures and created excellent opportunities for snorkelers to experience thriving coral reef ecosystems.

For several years the species has been attempting a comeback in several of the U.S. Virgin Islands national parks, where coral reef scientists have documented nearly 4 inches (10 cm) of growth per year. Ironically, the growth of the delicate branches has thwarted scientists' efforts to monitor change in the colony. As they grow, the branches fuse, creating a lattice of living creatures that is easily disturbed. Fortunately, a new mapping and monitoring method has emerged that does not disturb sensitive reef species and that increases the information available to resource managers.

Researchers based at NASA's Wallops Flight Facility (Virginia) and the USGS Center for Coastal and Watershed Studies (Florida) have developed a new airborne sensor, the NASA Experimental Advanced Airborne Research Lidar (EAARL), which assists scientists and managers of these precious resources. The sensor uses **lidar** (light detection and ranging) technology to rapidly survey elkhorn coral colonies, determining total area and mapping the microtopography of the sites. The technique also documents the surrounding terrestrial and

marine resources. The NASA EAARL instrument is attached to a fixed-wing aircraft and continuously transmits laser pulses, capturing the time-amplitude history of their reflections. The resulting "laser wave forms" are used to map the elevation of the ocean substrates and to generate three-dimensional information on vegetation canopies. In 2003 the South Florida/Caribbean Network coordinated with the USGS and NASA to collect lidar data from many of the network parks with coral reef resources.

By combining the lidar data with ground-based research findings, scientists are able to gain new information. A larger-scale application is comparing the mass of a complex coral reef with a barren seafloor. First, park resource managers collect location data for coral reefs using global positioning systems. They then combine the information with 1-meter-resolution lidar data to approximate the mass of an individual coral species for a park. Whereas measuring the mass of thousands of individual coral colonies could take months, this combination approach provides results in much less time. This baseline information will be critical to network parks as they begin to monitor the species' recovery and evaluate the impacts of future storms on this key marine resource. ■

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SPRING 2003 EAARL FLIGHTS OVER ST. JOHN, U.S. VIRGIN ISLANDS

In 2003 the South Florida/Caribbean Monitoring Network, in partnership with the NASA Wallops Flight Facility and USGS Center for Coastal and Watershed Studies, deployed lidar, a relatively new aerial survey tool that can be used to monitor sensitive coral reefs. Flights over Virgin Islands National Park were extensive in spring 2003 and resulted in useful information on the location, extent, and mass of the park's reefs.

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